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PATENT

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Art Unit 1742

Examiner: Daniel J. Jenkins

Applicants:

Morris F. Dilmore et al

Serial No:

10/039,811

Filed:

January 8, 2002

For:

METAL CONSOLIDATION PROCESS
APPLICABLE TO FUNCTIONALLY
GRADIENT MATERIAL (FGM)
COMPOSITIONS OF TANTALUM AND
OTHER MATERIALS

Pasadena, California
July 2, 2003

Assistant Commissioner for Patents

Arlington, VA 22313-1450

Attention: Official Draftsman

Sir:

The enclosed formal drawings are transmitted per
the requirement therefore accompanying the Notice of
Allowance.

Respectfully submitted,

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Enc.

Docket 12,105-1

In Figs. 9a and 9b, a penetrator 90 has combined cylindrical and tapered shape (as at sections 90a and 90b as shown), and is a solid body. Section 90b tapers toward tip 91. The penetrator is formed by the method of the invention, i.e. is a consolidated body, and has FGM property (increasing strength and/or ductility in axial length direction 93; and FGM property (decreasing strength and/or ductility) in center-to-side directions 94. Those directions are indicated by arrows as shown. Thus, the tip 91 and tapered wall 96 are stronger than the base 98; and body outer side 99 is stronger than body center 100'.

1 property (decreasing strength and/or ductility) in
2 axial length direction 87; and FGM property (decreasing
3 hardness and/or toughness) in wall thickness direction
4 88, those directions indicated by arrows, as shown.
5 Thus, the outer side is more ductile than the inner
6 side, and the nose 82 is more ductile than the base 81.

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8 combined cylindrical and tapered shape (as at sections
9 90a and 90b as shown), and is a solid body. Section
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11 the method of the invention, i.e. is a consolidated
12 body, and has FGM property (increasing strength and/or
13 ductility in axial length direction 93; and FGM
14 property (decreasing strength and/or ductility) in
15 center-to-side directions 94. Those directions are
16 indicated by arrows as shown. Thus, the tip 91 and
17 tapered wall 96 are stronger than the base 98; and body
18 outer side 99 is stronger than body center 100! ✓

19 In Figs. 10a and 10b, an EFP body 110 is
20 shown in side and bottom views. A body hollow 111 is
21 formed below a domed top 112.

22 In each of Figs. 8a, 8b, 9a, 9b, 10a, and
23 10b, the body at its toughest zone may consist of
24 tantalum, and at less tough zone may consist of
25 tantalum complexed with metal or metals selected from
26 the above HGM group.